RELIEF PORT

BACKGROUND OF THE INVENTION

[001] This invention relates generally to relief ports. More particularly, the invention relates to a vacuum relief port for a freezer.

[002] Relief ports are commonly installed in the walls of sealed compartments to provide a means for taking into or discharging air or other gas from the interior of the compartment in response to a pressure differential between the interior and exterior of the compartment. For example, in certain commercial enclosures, such as reach-in freezers, walk-in freezers and cold rooms, a partial vacuum often develops within the freezer compartment as a result of warm moist air entering the freezer compartment when the freezer door is opened. After the door is closed, the moisture in the entrained warm, moist air is removed as this air cools. As a result of this moisture removal and the decrease in volume as the air cools, a partial vacuum develops that, unless relieved, will make it difficult for someone to open the freezer door. Consequently, it is customary to provide a relief port in the wall of the freezer to provide a means for relieving the vacuum by allowing air to enter through the relief port to reestablish pressure equilibrium between the freezer interior and the environment on the exterior side of the freezer door.

[003] Lebahn, U.S. Patent 3,813,896, discloses a freezer air vent incorporating a gravity-biased, vacuum-responsive valve element, such as a ball or a hinged flap that opens and closes a vent passage through the wall of a freezer. Honda, U.S. Patent 5,421,775, discloses a ventilating apparatus which is installed in the wall of a compartment, such as a refrigerator, freezer, cold room and the like, to discharge air from within the compartment when the door is closed and to take in air from the outside when the door is opened, so as to facilitate the opening/closing operation of the door. The ventilating apparatus incorporates a pair of spring-biased, disk valve assemblies

that are spaced apart from each other within a flow passage extending through the wall of the compartment. Under the influence of pressure differential, the upper and lower portions of the disk valves open and close independently to either vent air in or out of the compartment.

[004] Finkelstein et al., U. S. patent 6,176,776, disclose a pressure relief port for mounting in the wall of a temperature-controlled enclosure to relief both positive and negative pressure differentials. The port includes upper and lower, pressure-responsive poppet valves disposed within a housing defining a flow passage through the wall of the enclosure. Air flows through the passage in one direction when the lower poppet valve opens and in the other direction when the upper poppet valve opens. The poppet valves pop upwardly to open and drop down under the influence of gravity to close.

SUMMARY OF THE INVENTION

[005] A relief port is provided for placement in a wall of an enclosure separating a first environment within the enclosure from a second environment external of the enclosure. The relief port includes a housing adapted to mount in the wall of the enclosure to define a passage to provide flow communication through the wall between the first environment and the second environment, and a valve assembly associated with the housing. The valve assembly has a base member that extends across the passage and a valve member operatively associated with the base member At least one flow port is provided in the base member. The valve member has a resilient body that is responsive to a pressure differential between the first environment and the second environment acting across the valve member. The resilient body covers the flow port to close the flow passage to flow whenever the pressure within the first environment is equal to or above the pressure within the second environment. Whenever the pressure within the first environment drops below the pressure within the second environment, the resilient body flexes away from the flow port to open the flow port to flow through the flow passage from the second environment to the first environment.

BRIEF DESCRIPTION OF THE DRAWINGS

[006] The drawings that accompany the detailed description can be briefly described as follows:

[007] Figure 1 is a cross sectional view of a one embodiment of a pressure relief port incorporating the principles of the present invention;

[008] Figure 2 is an end view of the relief port of Figure 1 taken along line 2-2 of Figure 1;

[009] Figure 3 is an end view of the relief port of Figure 2 taken along line 3-3 of Figure 1;

[010] Figure 4 is a cross sectional view of the valve assembly of the relief port of Figure 1 with the valve assembly in its closed position; and

[011] Figure 5 is a cross-sectional view of the valve assembly of the relief port of Figure 1 with the valve assembly in its open position.

DETAILED DESCRIPTION

[012] Referring now to the drawing, the relief port 10 is depicted installed in the insulated wall 12 of a walk-in freezer. It is to be understood, however, that the relief port 10 may be installed in the wall of any enclosure separating a first environment on one side of the wall and a second environment on the other side of the wall.

[013] Referring now, in particular, to Figures 1 through 3, the relief port 10 is includes a housing 20, depicted as a tubular member, that defines a passage to provide flow communication through the wall 12 between the relatively dry, cold environment 2 within the interior of the walk-in freezer and the relatively moist, ambient environment 4 exteriorly thereof. The housing 20 of the relief port 10 is installed in a through-hole 15 extending between an opening 13 in an inner skin 14 of the wall 12 and an opening 17 in an outer skin 16 of the wall 12. In a walk-in freezer, the wall 12 has a layer of foam insulation 18 disposed between the inner skin 14 and outer skin 16. The relief port 10 may be installed in a through-hole 15 that is drilled through an already formed wall 12, particularly in retrofit applications. Alternatively, the relief port 10 may be installed between the respective openings 13 and 17 in the inner and outer skins before the insulation layer is foamed in place about the housing 20 of the relief port 10 between the inner and outer skins to form the insulated wall 12. In applications wherein the wall 12 separates a relatively cool environment from a relatively warm environment, the housing 20 may be form of plastic or other material having a low heat conductivity.

[0014] Further, the housing 20 may be formed of first and second portions 22 and 24 which mate telescopically by inserting the second portion 24 into the first portion 22 to form the housing 20. In the depicted embodiment, the second portion 24 is a tubular member having a plurality of flexible ridges 23 extending about its outer circumference, and the first portion 22 is a tubular member having a plurality of flexible ridges 25 extending about its inner circumference. To form the housing 20, the first portion 22 is inserted through the opening 17 in the outer skin 16 of the wall 12 and the second portion 24 is inserted through the opening 15 in the inner skin 14 to mate with the first portion 22 such that the ridges 25 inner-lock with the ridges 23 in snap-fit fashion. In this manner, the housing 20 can be made to accommodate a wide range of wall thicknesses.

[0015] Advantageously, a pair of end caps 30 and 40 may be mounted to the respective ends of the housing 20 to seal the passage through the housing against vermin access. The first end cap 30 has a central cover portion 32 extending across the end face 24 of the housing 20 and a seal lip 34 that extends circumferentially about the cover portion 32 and outwardly therefrom to seal against the outer skin 16 of the wall 12. The second end cap 40 has a central cover portion 42 extending across the end face 28 of the housing 20 and a seal lip 44 that extends circumferentially about the cover portion 42 and outwardly therefrom to seal against the inner skin 14 of the wall 12. The seal lips 34 and 44 may be made of rubber or a resilient plastic material to ensure an air tight seal between the housing 20 and the opening 13 through which it extends. To provide for flow between the first and second environments via the flow passage defined by the housing 20, at least one flow opening, and preferably a plurality of flow openings, for example holes 35 and 45, are provided in the respective cover portions 32 and 42 of the end caps 30 and 40. Although illustrated as a plurality of circular holes disposed in a circular pattern symmetrically about the center of the end cap, it is to be understood that the flow openings 35 and 45 may be of any desired size, of any desired shape, such as slots, and be distributed in any desired pattern over the cover portion of the respective end caps 30 and 40.

[0016] Referring now to Figures 4 and 5, in particular, the depicted valve assembly 50 comprises an umbrella valve having a resilient valve cover 52 and a stem 54 extending axially outwardly from the center of the valve cover 52. The valve stem 54 extends through a central opening in a base member that extends across the flow passage of the housing 20 and has a plurality of flow openings formed therein. Advantageously, the cover portion 32 of the end cap 30 may serve as the base member of the valve assembly, with the valve stem 54 extending through a hole 36 located centrally in the cover portion 32. A stop 56 may be provided on the stem 54 of the valve assembly 50 to mount the valve assembly to the end cap 30.

[0017] As noted previously, when the pressure within the first environment 2 is equal to the pressure within the second environment 4, there will be no pressure differential acting across the valve assembly and the valve assembly 50 will be in its normal closed position. Similarly, if the pressure within the first environment exceeds the pressure within the second environment, the pressure differential acting across the valve assembly will hold the valve assembly 50 in its normal closed position. In the closed position, as illustrated in Figure 4, the resilient valve cover 52 resembles an umbrella that extends over the flow openings 35 in the cover portion 32 of the end cap 30 with the outer circumferential portion of the valve cover 52 abutting and sealing about its circumference against the cover portion 32 thereby preventing flow through the passage defined by the housing 20. However, when the pressure within the first environment 2 drops below the pressure within the second environment 4, the pressure differential acting across the valve assembly will cause the resilient valve cover 52 to balloon out away from the cover portion 32, as illustrated in Figure 5, thereby opening the flow passage defined by the housing 50 to flow entering from the second environment 4 through the openings 35. The flow passing through the openings 35 will pass through the gap 60 now existing between the valve cover 52 and the end cap 30 and thence flow through the flow passage defined by the housing 50 to enter the first environment 2 through the openings 45 in the second end cap 40.

[0018] The aforementioned description, in which a preferred embodiment of the relief port has been disclosed, is exemplary in nature, rather that limiting. Those skilled in the art will recognize that various modifications and alterations of the present invention are possible in light of the above teachings, without departing from the scope of the invention. It is to be understood that the invention may be practiced within the scope of the appended claims, but otherwise than as specifically described in the detailed description hereinbefore presented. For example, one skilled in the art will recognize that the valve assembly of the relief port may readily modified to utilize an equivalent valve, such as a duckbill valve, as opposed to an umbrella valve.